FAA-E-2386
April 3, 1969

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION SPECIFICATION

REMOTE MONITOR AND CONTROL PANEL FOR USE WITH TYPE IRA RVR SIGNAL DATA CONVERTER

1. SCOPE AND CLASSIFICATION

1.1 Scope.- This specification sets forth the requirements for a Remote Monitor and Control Panel (RMCP) for use with an IRA Runway Visual Range (RVR) Signal Data Converter. This panel can be located at a distance of up to 25 miles from an RVR power supply and control panel and provides the capability for monitoring the outputs and condition of operation of any one of eight Signal Data Converter (SDC) systems. The panel has the further capability of initiating three maintenance checks which are required to verify RVR system operation.

1.2 Classification.- Three types of equipment are covered by this specification.

1.2.1 Type I equipment.- Type I equipment permits one telephone line to connect each signal data converter interface unit with the RMCP (see Figure 1). This permits a maximum of eight telephone lines to the RMCP.

1.2.2 Type II equipment.- Type II equipment permits only one telephone line to interconnect a maximum of eight signal data converters, through required interfaces, to one RMCP (see Figure 2).

1.2.3 Type III equipment.- Type III equipment permits two telephone lines to connect each signal data converter interface unit with the RMCP for conducting simultaneous exchange of information between each of these two points (see Figure 1). This permits a maximum of sixteen telephone lines to the RMCP.

2. APPLICABLE DOCUMENTS

2.1 FAA documents.- The following FAA specifications and standards, of the issues specified in the invitation for bids or request for proposals, form a part of this specification and are applicable to the extent specified herein.

2.1.1 FAA specifications

FAA-G-2100/1	Electronic Equipment, General Requirements; Part 1, General Requirements for all Equipment
FAA-G-2100/3	Requirements for Equipments Employing Semiconductor Devices
FAA-G-2100/4	Requirements for Equipments Employing Printed Wiring Techniques
FAA-D-638	Instruction Books, Electronic Equipment
FAA-D-2129	Contractor Prepared Technical Reports, Research and Development Contracts (applicable to prototype equipment)

2.1.2 FAA standards

FAA-STD-005	Preparation of Specification Documents
FAA-STD-013	Quality Control Program Requirements

2.2 Military and Federal publications.- The following Military and Federal publications, of the issues in effect on the date of the invitation for bids or request for proposals, form a part of this specification and are applicable to the extent specified herein.

2.2.1 Military documents

MIL-E-5400	Electronic Equipment, Aircraft, General Specification for
MIL-E-17555	Electronic and Electrical Equipment and Associated Repair Parts, Preparation for Delivery of
MIL-STD-129	Marking for Shipment and Storage
MS-33558	Standard Form of Numerals and Letters, Aircraft Instrument Dial
MIL-STD-188	Military Communications System Technical Standards
MIL-STD-785	Requirements for Reliability Program (For Systems and Equipments)

MIL-STD-470 Maintainability Program Requirements (For Systems and Equipments)

2.2.2 Federal standard

Fed. STD. 102 Preservation, Packaging and Packing Levels

2.3 Other publications.- The following publication forms a part of this specification and is applicable to the extent specified herein.

Instruction book for RVR system manufactured by Industrial Research Associates, Inc.

(Copies of this specification, applicable FAA documents and the RVR instruction book may be obtained from the Contracting Officer in the Federal Aviation Administration Office issuing the invitation for bids or request for proposals. Requests should fully identify material desired, i.e., specification, standard, etc., numbers and dates. Requests should cite the invitation for bids, request for proposals, or the contract involved or other use to be made of the requested material.)

(Information on obtaining copies of Federal standards may be obtained from General Services Administration offices in Atlanta; Auburn, Wash.; Boston; Chicago; Denver; Fort Worth; Kansas City, Mo.; Los Angeles; New Orleans; New York; San Francisco; and Washington, D.C.)

(Single copies of Military specifications and standards may be obtained from Federal Aviation Administration, Washington, D.C. 20590, ATTN: Contracting Officer. Requests should cite the invitation for bids, request for proposals, or contract for which the material is needed. Mail requests, if found acceptable, will be forwarded to a Military supply depot for filling; hence, ample time should be allowed.)

3. REQUIREMENTS

3.1 Equipment to be furnished by the contractor.- The RMCP furnished by the contractor shall be constructed in accordance with Specifications FAA-G-2100/1, FAA-G-2100/3, FAA-G-2100/4 and shall be complete in accordance with all specification requirements. The contractor shall supply the following:

(a) RVR Remote Monitor and Control Panel (RMCP), and associated panels, of the type specified in the contract.

(b) Cabling as required to connect eight signal data converters to each RMCP supplied.

(c) Cable connectors of type and quantity provided on interconnecting cables.

(d) Instruction books in accordance with FAA-D-638.

3.1.1 Special tools for installation and maintenance.- All special tools necessary for repair, adjustment and maintenance of the equipment covered by this specification shall be supplied with these items.

3.1.2 Prototype equipment.- Prototype equipment as required in the contract schedule shall be furnished as per requirement of paragraph 3.15 and its subparagraphs.

3.2 General functional requirements.- The equipment specified herein shall consist of an RMCP with such ancillary equipment as may be required to monitor on a selected basis the RVR reading developed by up to eight signal data converters. The panel shall duplicate the control functions provided by the existing IRA RVR power supply and control panel equipment, and permit an operator to perform the same functions from a remote location. Reference shall be made to the instruction book for a detailed description of the functions specified in paragraphs 3.2.2 - 3.2.6. The RMCP shall provide the following functions.

3.2.1 Signal data converter selection.- The RMCP by means of a rotating switch shall be capable of selecting and monitoring any one of eight signal data converters. The current RVR value of the selected signal data converter shall be displayed immediately after selection.

3.2.1.1 Identification of selected runway.- The signal data converter selected by means of a rotating switch shall be identified by an illuminated marker on the RMCP. The illuminated marker shall be provided with means of displaying any desired runway number in the range of 01 to 36 inclusive, as well as L and R. If the contractor elects to satisfy this requirement by use of transparent printed overlays, two sets shall be provided.

3.2.1.2 Variable intensity control for identification markers.- The illuminated runway designation markers shall be provided with a control permitting variation of the intensity of its illumination. The control shall vary this intensity over a range from maximum to extinction. Maximum illumination shall be such, as to permit adequate reading under 200 foot candles of daylight conditions from a distance of 10 feet. This intensity control shall simultaneously control the illumination of the RVR readout.

3.2.1.3 RVR readout.- The RVR reading of the selected signal data converter shall be displayed on a digital drum readout. Numerals shall be white figures on a black background in conformance with Military Standard MS-33558, 5/16 inch in height and $\frac{1}{4}$ inch in width. Each individual digit display shall be internally illuminated by means of bulbs having a rated life of 100,000 hours. Indicators shall be of high reliability, long life construction and conform to MIL-E-5400, Class 2. Lubricated bearings shall not be permitted.

3.2.2 Light setting value.- The RMCP shall display the light setting value in use at the selected signal data converter.

3.2.3 Background count.- The RMCP shall be provided with a push-button control to permit initiation of a background count at the selected signal data converter.

3.2.4 Tests 1 and 2.- The RMCP shall be provided with a rotating switch control or controls to permit initiation of Tests 1 and 2 as described in the RVR Instruction Book for any selected signal data converter and for any look-up table of the selected equipment.

3.2.5 Alarm.- The RMCP shall be provided with alarm circuitry which will sound an alarm and light a lamp when any displayed RVR value is equal to or less than a preset value. The system shall consist of a bell, an orange light and two rotating switches marked "ALARM SETTING". The first switch shall have the following positions: Off, 0, 10, 20, 30, 40, 50, 60; the second shall have the positions 0, 2, 4, 5, 6, 8. All values are expressed in hundreds of feet. This combination shall permit the alarm to activate when the visibility reaches any preset position from 600 to 6,000 feet. The alarm value shall be obtained by summing the values on the two switches. Once set, the bell shall sound once and the orange light shall glow whenever an RVR value appears in the display that is equal to or below the preset value. The "off" position shall make the alarm inoperative. The bell shall ring once each time the display is updated (approximately once each minute). The display alarm shall operate independently of all other alarms in the total system. The alarm and indicator lamps shall be similar to the lamps performing the same function in the power supply panel, but may be reduced in size provided approval is obtained from the government and the proposed lamp have a rated life of 50,000 hours.

3.3 Service conditions.- The equipment shall be designed to operate under conditions of line voltage, line frequency, temperature and humidity conditions as specified below in 3.3.1 and 3.3.2.

3.3.1 AC line voltage and frequency.- The equipment shall operate from a single phase two wire AC line power source having a design center voltage of 120 volts 60 Hz (1-3.2.21, FAA-G-2100/1).

3.3.2 Ambient conditions.- The ambient conditions shall be those of Environment I (1-3.2.23, FAA-G-2100/1).

3.3.3 Reliability.- The RMCP shall have a design objective of 20,000 hours mean-time-between-failure (MTBF) in accordance with MIL-STD-785.

3.3.4 Maintainability.- The system shall be designed in accordance with MIL-STD-470 with a minimum number of moving parts as is consistent with the state-of-the-art for the type of system supplied. The electrical and mechanical design shall provide for minimum maintenance with all components readily accessible. The mean-time-to-repair (MTTR) of the RMCP shall not be more than 30 minutes.

3.3.5 Extension boards.- One set of extension boards shall be provided to permit maintenance check of boards in an extended position with

equipment in operation. Duplicate extension boards need not be provided. Each board shall be appropriately identified as to its use and location.

3.4 Interface panel.- An interface panel or panels shall be provided as an interface for the existing signal data converter system's control and power supply with the RMCP. The interface panel shall be located in the same rack with the signal data converter and provide the necessary inputs and outputs to the signal data converter system and RMCP. The interface panel shall be designed to permit operation of the RMCP with minimum modification of the signal data converter system. Any required modification shall be of a type which may be expeditiously completed under field service conditions by a maintenance technician.

3.4.1 Signal conditioner.- A signal conditioner, where required under Type II equipment, shall have the capability of transmitting control information through two-wire telephone line when connected to the RMCP as required by 3.7. It shall provide eight inputs and one output.

3.5 Panel design, interface and RMCP.- Design and construction of panels for interface and RMCP shall be in accordance with Specification FAA-G-2100/1 with the exception that the panel and chassis design shall be of the pull-out type. Design and construction of the chassis-panel shall be similar and equal to that of the chassis-panels included with the equipment as specified in paragraph 1.2.

3.6 Equipment type.- The equipment type shall be that required by the contract document and as defined in 1.2 hereof and shown in Figures 1 and 2.

3.7 Interconnecting wiring.- The number of connecting wires between the signal data converter, its corresponding interface panel and signal conditioner when provided shall be a minimum. Interconnecting cables shall be ten feet in length. Connection between each interface panel and the remote panel, or between each signal conditioner and the remote panel shall be by two wire No. 19 gauge telephone lines which do not pass through repeaters, central office switching equipment or other sources of interference with DC continuity. The number of lines shall be that permitted by Type I, II or III (defined in 1.2.1, 1.2.2 and 1.2.3 hereof) as required by the contract document. The RMCP can be located up to 25 miles (50 loop miles) from the RVR power supply and control panel.

3.7.1 Communication circuitry characteristics.- The equipment design communication circuitry characteristics shall be in accordance with the applicable portions of MIL-STD-188.

3.8 Extra connectors.- One complete set of connectors shall be provided to permit local fabrication of identical cables of extended length by the FAA. This set shall duplicate in type and quantity the connectors provided by the manufacturer on all interconnecting cabling, and shall be in accordance with paragraph 1-3.16.3.1 of FAA-G-2100/1.

3.9 Local-remote operation.- The interface panel located with the signal data converter shall be considered as the local position. The RMCP shall be considered as the remote position. The local position shall have provision for transferring control of the monitor and test function to the remote position and regaining control as desired. Transferring these functions to the remote position shall not disable the RVR readout function at the local position. The remote position shall be provided with a means of advising the operator that a selected signal data converter is, or is not, available for test initiation from the remote position.

3.10 Semiconductor devices.- The use of semiconductors in accordance with FAA-G-2100/3 is mandatory except as permitted by 3.12.

3.11 Printed wiring.- The use of printed wiring in accordance with FAA-G-2100/4 is mandatory except as permitted by 3.12.

3.12 Integrated circuitry.- The use of integrated circuitry is permitted where equipment design, or reliability, makes this desirable. When integrated circuitry components are utilized, they shall be of high reliability and readily available from more than one supplier.

3.13 Nameplates.- Nameplates shall be provided in accordance with FAA-G-2100/1. The equipment title shall be: Remote Monitor and Control Panel. Interface units shall be appropriately titled by the contractor. Nameplates shall be submitted for approval as provided in FAA-G-2100/1. The specification type (1.2.1, 1.2.2, 1.2.3, 3.6) shall not appear on the nameplate; type designations for nameplate use will be furnish per 1-3.13 of FAA-G-2100/1.

3.14 Contractor supplied test equipment.- In addition to the testing requirements of the contract originating from this specification, the contractor shall provide one set of RVR signal data converter equipment. This equipment is not deliverable to the Government, but shall be provided for the purpose of demonstrating the operation of the RMCP in the contractor's plant. The Government assumes no responsibility for making this test equipment available to the contractor.

3.15 Optional prototype equipment.- Prototype equipment when required by the contract shall meet all requirements of this specification including the requirements of the following subparagraphs.

3.15.1 Design report.- The contractor shall submit a preliminary design report to the Contracting Officer within 45 days after contract award. The preliminary design shall include the configuration of all chassis, panels, circuitry and a set of sketches to show the layout and theory of operation. The design report shall include fully documented reliability data with listing of all parts by type and failure rate in support of the MTBF (3.3.3) which is expected to be realized.

3.15.2 Test.- All tests required by Section 4 of this specification shall apply to the prototype equipment.

3.15.3 Progress reports.- Progress reports prepared in accordance with Specification FAA-D-2129 shall cover design, fabrication and test of the prototype equipment, and shall be submitted in accordance with the contract.

3.15.4 Instruction books.- Instruction books shall be furnished in accordance with FAA-D-2350.

4. QUALITY ASSURANCE PROVISIONS

4.1 Quality control requirements.- The contractor shall provide and maintain an inspection program in accordance with FAA-STD-013.

4.2 Testing general.- All inspections and tests specified herein shall be performed at the contractor's plant (at one location in the contiguous United States) in accordance with FAA-G-2100/1.

4.3 Tests.- Three classes of tests are covered by this specification as follows:

(a) Prototype tests as required in paragraphs 4.7.1 to 4.7.6 and verification of reliability and mean-time-between-failure.

(b) Type tests as required in paragraph 4.7.6.

(c) Production tests as required in paragraphs 4.7.3.1 to 4.7.3.9.

4.4 Prototype tests.- Tests required for the prototype system are under 4.7.1 to 4.7.6.

4.5 Type tests.- Type tests shall be made on production units in accordance with FAA-G-2100/1 and consist of the following: 4.7.3 to 4.7.6.

4.6 Production tests.- Production tests required are under 4.7.3.1 to 4.7.3.9.

4.7 Performance tests.- The following tests shall be performed.

4.7.1 Contractor's preliminary tests.- These tests shall be conducted as described in FAA-G-2100/1.

4.7.2 Design qualification tests.- The following design qualification tests shall be performed.

4.7.2.1 Rating tests for parts and materials.- Refer to FAA-G-2100/1, paragraph 1-4.3.2.1.

4.7.2.2 General specification tests.- Refer to FAA-G-2100/1, paragraph 1-4.3.2.2.

4.7.2.3 Verification of reliability and mean-time-between-failure design (3.3.3 - 3.3.4).- A theoretical analysis shall be prepared to satisfy this requirement in accordance with 5.1.9, MIL-STD-785.

4.7.3 System test.- The following tests shall be conducted at normal test conditions as defined in FAA-G-2100/1, paragraph 1-3.2.22. The equipment shall be connected as shown in Figures 1 and 2 as applicable to the equipment procured. Operational conditions shall be performed to simulate 25 miles (50 loop miles) of cabling. The test apparatus, as a self contained unit, used to simulate the 25 miles of cabling shall be delivered with the prototype system.

4.7.3.1 Signal data converter selection.- Capability of system to select any one of eight signal data converters shall be demonstrated. The RMCP shall correctly display the RVR reading and light setting value of each selected signal data converters. Selected RVR values shall be displayed immediately. See 3.2.1

4.7.3.2 Light setting values.- The light setting value of the selected signal data converter shall be changed at the signal data converter to show each light setting value (3D, 4D, 5D, 3N, 4N, 5N). The monitor panel shall give identical indications. See 3.2.2

4.7.3.3 Runway identification.- Capability of identifying the selected runway shall be demonstrated. See 3.2.1.1

4.7.3.4 Variable intensity control.- Capability of varying intensity of illumination for digital readout and runway identification from maximum to extinction shall be demonstrated. See 3.2.1.2

4.7.3.5 Background count.- Capability of panel to initiate background count, and give required indications for each selected signal data converter shall be demonstrated. See 3.2.3

4.7.3.6 Tests 1 and 2.- Capability of panel to initiate Tests 1 and 2, and give required indications for each selected signal data converter shall be demonstrated. See 3.2.4

4.7.3.7 Light setting table selection.- Capability of the panel to select tables 3D, 4D, 5D, 3N, 4N, 5N for each selected signal data converter shall be demonstrated. See 3.2.4

4.7.3.8 Alarm circuit.- The alarm circuit shall be tested at each alarm setting to show correct response for each selected signal data converter. See 3.2.5

4.7.3.9 Local-remote operation.- Local-remote advice capability shall be demonstrated. Refer to 3.9

4.7.4 Forty-eight hour test.- The RMCP shall be connected through its interface panel to a signal data converter. The entire system shall operate accurately for a forty-eight-hour period at Test Position 1. Normal test conditions apply.

4.7.5 Indicator temperature test.- The indicator used in the system shall be tested at 40° C under operating conditions of Test 1 for an eight-hour period and operate without error during that period. This test shall be in addition to tests conducted on the indicator as a part of the equipment.

4.7.6 Temperature humidity test.- The monitor and control panel, and associated interface units shall be tested in accordance with FAA-G-2100/1 under conditions of Environment I for the following:

Signal Data Converter Selection
Background Count Initiation
Initiation Tests 1 and 2
Alarm Circuit Operation

These tests shall be conducted at 102 V and 138 V, 60 Hz. The contractor shall certify that the equipment will meet all applicable specification requirements at 57 Hz and 63 Hz.

5. PREPARATION FOR DELIVERY

5.1 General.- The definitions and applications of the various levels of preservation, packaging and packing shall be as specified in Fed. STD. 102.

5.2 Preservation, packaging and packing.- The preservation, packaging and packing shall be level C, unless otherwise specified in the contract schedule, in accordance with MIL-E-17555.

5.2.1 Unit package.

5.2.1.1 Weight and size limitations.- Unless the weight of a single item exceeds the specified limitation, the gross weight of the unit package shall not exceed 200 pounds. The size of the unit package shall conform to the rules and regulations applicable to the mode of transportation selected.

5.2.1.2 Components.- The unit package shall consist of individual components of the system as defined in paragraph 5.2.3 and in the quantities specified in the Invitation For Bids, Request For Proposals or Contract.

5.2.2 Prototype system.- Individually packaged units of the prototype system shall consist of one remote monitor and control panel, eight interface panels, one signal conditioner where ordered, interconnecting cabling as required in 3.7, and the test unit for simulating 25 miles of cabling as required in 4.7.3.

5.2.3 Production system.- The unit package shall consist of a remote monitor and control panel, a signal conditioner where required, an interface panel and the necessary interconnecting cabling as required in 3.7, in the quantities specified in the Invitation For Bids, Request For Proposals or Contract. If the system unit package exceeds

the weight and size limitations above, then the system shall be packaged in the minimum number of containers.

5.3 Marking.- Unit packages and exterior shipping containers shall be marked in accordance with MIL-STD-129. When a system is shipped in two or more containers, the set marking specified by 5.5.2 of the standard shall be included.

6. NOTES

6.1 Note on information items.- The contents of this Section 6 are only for the information of the initiator of the procurement request and are not a part of the requirements of this specification. They are not contract requirements nor binding on either the Government or the contractor. In order for these terms to become a part of the resulting contract, they must be specifically incorporated in the schedule of the contract. Any reliance placed by the contractor on the information in these subparagraphs is wholly at the contractor's own risk.

6.2 Intended use.- The RMCP specified herein is to be utilized with RVR equipment manufactured for the U.S. Department of Commerce Weather Bureau under Contract 10-4-07 and may include as many as eight interface units as required (see Figures 1 and 2).

6.3 Conditions.- This specification is issued as a two-phase document.

Phase I	Prototype
Phase II	Production

6.3.1 Prototype model (Phase I).- The contract schedule should contain a requirement for the design, fabrication, test and delivery of a prototype model consisting of the following components:

Remote Monitor and Control Panel	(1 each)
Interface Panel	(8 each)
Signal Conditioner (if ordered)	(1 each)
Cable Distance Test Unit	(1 each)
Cable (as required in 3.7)	
Instruction Books, Type B, FAA-D-2350	(15 each)

6.3.2 Production equipment (Phase II).- Production should not begin until the first phase (prototype) has been completed and the prototype equipment evaluated by the Government. A three-month period should be allowed between phases to permit additional Government evaluation of the prototype unit. Additional items to be supplied as part of the production contract requirement:

Interface panels
Instruction books in accordance with FAA-D-638 (see 6.3.3)
Parts peculiar to be selected at a provisioning conference

6.3.3 Preliminary instruction books.- Two each Preliminary Instruction Books, for the production model shall be supplied with each system shipped, in accordance with FAA-D-638 and 15 extra copies for stock.

6.4 Descriptive data.- The bidder should submit with his proposal descriptive data which describes the equipment to be furnished. In addition, the bidder may submit for consideration, variations in the specification which will not derogate the system function described in Figures 1 and 2, functional requirements (3.2), reliability (3.3.3), mean-time-between-failure (3.3.3), and maintainability requirements of this system (3.3.4), but which will result in a lower overall cost to the Government.

6.5 Ordering data.- For ordering data, see paragraphs 3.1.a, 3.6, 5.2, and 5.2.1.2.

6.6 Out-of-agency training.- Provision should be made for out-of-agency training for Academy instructors and equipment for inclusion in the present RVR course at the Academy.

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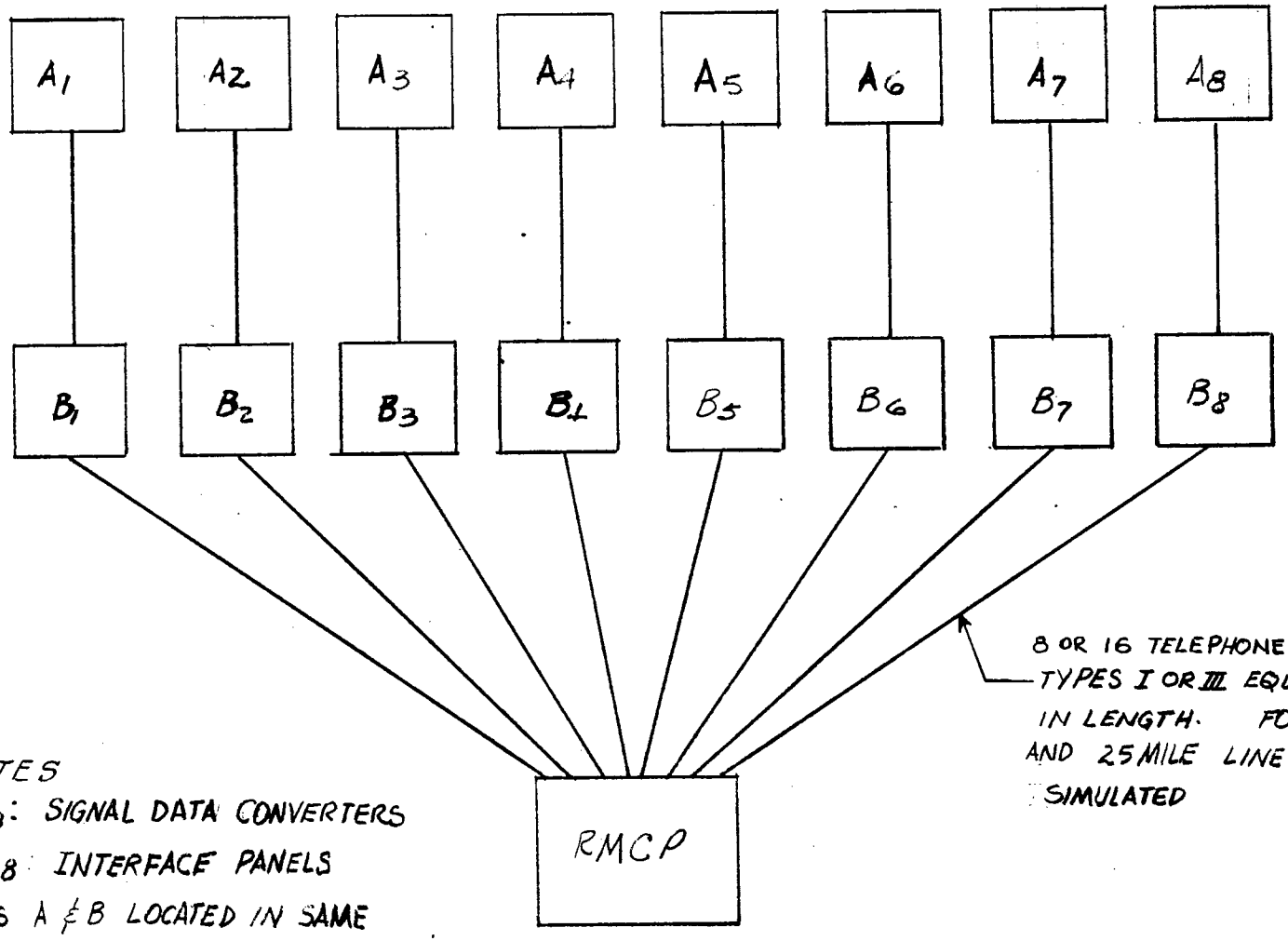
REMOTE MONITOR AND CONTROL PANEL

TYPE I OR III EQUIPMENT



NOTES

A_1-A_8: SIGNAL DATA CONVERTERS

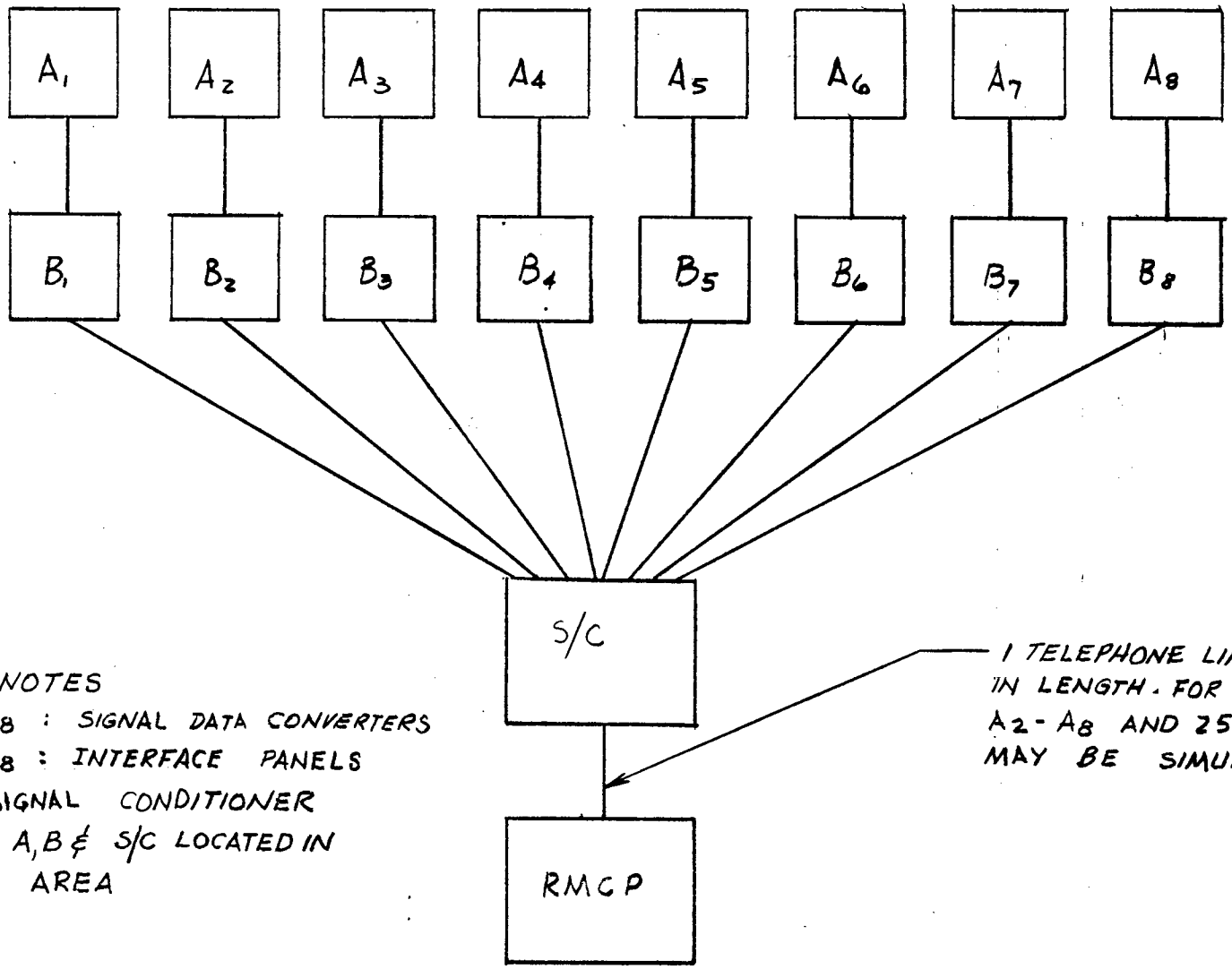
B_1-B_8 INTERFACE PANELS

ITEMS A & B LOCATED IN SAME AREA

FIGURE 1

REMOTE MONITOR AND CONTROL PANEL

TYPE II EQUIPMENT



NOTES

$A_1 - A_8$: SIGNAL DATA CONVERTERS

$B_1 - B_8$: INTERFACE PANELS

S/C : SIGNAL CONDITIONER

ITEMS A, B & S/C LOCATED IN SAME AREA

FIGURE 2